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## Preparing a 21<sup>st</sup> Century Workforce

### *Science, Technology, Engineering, and Mathematics (STEM) Education in the 2014 Budget*

“We’ll reward schools that develop new partnerships with colleges and employers, and create classes that focus on science, technology, engineering, and math – the skills today’s employers are looking for to fill jobs right now and in the future.”

- President Barack Obama  
February 2013

President Obama strongly believes that the United States must equip many more students to excel in science, technology, engineering and mathematics (STEM). That’s why the President’s 2014 Budget invests \$3.1 billion in programs across the Federal government on STEM education, an increase of 6.7 percent over 2012 funding levels (see Table). The 2014 Budget includes critical investments in a number of areas that will benefit aspiring students:

- Recruiting, preparing and supporting excellent STEM teachers, with \$80 million to support the President’s goal of preparing 100,000 excellent STEM teachers and \$35 million to launch a pilot STEM Master Teacher Corps.
- Supporting more STEM-focused high schools and districts, with an investment of \$150 million to create new STEM Innovation Networks to better connect school districts with local, regional, and national resources. In addition, the Department of Education (ED) will invest \$300 million to support re-design of high schools to encourage partnerships with colleges, employers, or community partners, focusing on high-demand employment sectors such as STEM fields.
- Improving undergraduate STEM education, with the National Science Foundation (NSF) launching a \$123 million new program to improve retention of undergraduates in STEM fields and improve undergraduate teaching and learning in STEM subjects to meet the President’s goal of preparing 1 million more STEM graduates over the next decade.
- Investing in breakthrough research on STEM teaching and learning, with approximately \$65 million for the Advanced Research Projects Agency for Education (ARPA-ED), which would allow the Department of Education to support high-risk, high-return research on next-generation learning technologies, including for STEM education.

In addition, by decreasing the number of STEM programs from 226 to 112 – a 50 percent reduction – the President’s 2014 Budget makes disciplined choices to reorganize and cut back lower-priority programs to make room for targeted increases. This includes the proposed elimination or reorganization of 114 programs, with approximately \$180 million in savings strategically reinvested in new or existing STEM programs. This reorganization effort will substantially decrease the fragmentation of STEM programs across the Federal government,

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allowing for easier coordination and improving opportunities for rigorous evaluation of the remaining programs. The reorganization also includes increasing capacity at critical agencies.

## **K-12 Education**

The President's 2014 Budget includes investments to improve STEM education in schools, with a priority on excellent teachers, rigorous courses, and partnerships that leverage the scientific and higher education communities while broadening participation from underrepresented groups.

The Department of Education (ED) will launch a \$265 million STEM Innovation Initiative with inter-related investments that will help ensure our Nation's students are prepared to succeed in a global economy increasingly reliant on STEM knowledge. These investments include:

- **STEM Innovation Networks:** The Budget invests \$150 million to help school districts, individually or in consortia, to build strategic partnerships with universities, Federal science agencies, businesses, museums, skilled volunteers and other educational entities, such as the partnership between the Ohio STEM Learning Network, the Cleveland Metropolitan School District, GE, and MC2High School. These partnerships – STEM Innovation Networks – will help district leaders harness local, regional, and national resources to transform STEM teaching and learning by, for example, implementing innovative research-based practices, and building teacher capacity. Each network will engage in activities based on local needs, such as providing quality professional development to STEM teachers and developing and evaluating instructional models that help students meet STEM-focused, college and career-ready standards. The Budget will also provide \$5 million to support a STEM Virtual Learning Network, a national, online community of STEM educators that will enable them to exchange STEM education materials and best practices, including those developed through the Innovation Networks. These networks will build on the \$150 million investment in ED's Math and Science Partnership program (proposed for reauthorization as Effective Teaching and Learning: STEM).
- **Preparing 100,000 Excellent STEM Teachers over the Next Decade:** In his 2011 State of the Union address, the President called for a new effort to prepare 100,000 STEM teachers over the next decade with strong teaching skills and deep content knowledge. Answering the President's call to action, more than 150 organizations, led by Carnegie Corporation of New York, have formed a coalition called *100Kin10*. Members of the coalition have made more than 100 commitments to support STEM teacher preparation. Last month, the Howard Hughes Medical Institute announced an additional \$22.5 million investment in support of the President's goal. To build on these private-sector investments, ED is proposing \$80 million in the 2014 Budget to support evidence-based STEM teacher preparation programs to recruit and train effective STEM teachers for high-need schools.
- **STEM Master Teacher Corps:** The Budget also includes \$35 million to launch a pilot of the STEM Master Teacher Corps, a new effort enlisting some of America's best and brightest science and math teachers that will help to improve instruction in their schools

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and districts, and to serve as a national resource for best practices in math and science teaching.

The President's Budget makes other investments to support ED's STEM Innovation Initiative:

- STEM-focused high schools: The President's Budget includes a \$300 million investment at ED for a new competition to kick-start a redesign of high schools to emphasize real-world learning. The President's plan will invest in redesigning high schools to focus on providing challenging, relevant experiences, and preparing students for college and careers. Schools will develop new partnerships with colleges, community partners or employers and many can focus on STEM subjects and skills, and ensuring that our nation's capacity to create and innovate is never limited by a shortage of talent.
- Identifying innovative STEM education practices: The Administration proposes \$102 million to support NSF's Discovery Research K-12, which supports research on teaching and learning in STEM, and to create research-based scalable resources, models, and tools.

### **Undergraduate STEM Education**

The focus of the 2014 Budget's undergraduate STEM investments is on implementing a cross-agency priority goal to increase the number of well-prepared graduates with STEM degrees by one million over the next 10 years. Informed by recommendations of the President's Council of Advisors on Science and Technology (PCAST), the Administration has launched a Federal government-wide effort to meet this goal. In support, the 2014 Budget includes investments to:

- Transform undergraduate teaching and learning with NSF investments: The Budget proposes over \$120 million for an integrated program – Catalyzing Advances in Undergraduate STEM Education (CAUSE) – to support the President's goal of producing one million more STEM graduates in the next ten years. Goals include improving STEM learning and learning environments, broadening participation in STEM, increasing institutional capacity, and building the STEM workforce of tomorrow.
- Improve STEM education at community colleges: The Administration proposes \$64 million for NSF's Advanced Technological Education (ATE) program, which focuses on education of technicians for the high-technology fields, with a focus on partnerships between academic institutions and employers.

### **Graduate Education**

The focus of the 2014 Budget's graduate STEM investments is on preparing highly-skilled scientists and engineers, and leveraging NSF's strong expertise in managing fellowships. Priorities include:

- Enhancing NSF's graduate fellowship program: By reorganizing or eliminating smaller fellowship programs, the Budget will provide \$325 million to expand and enhance NSF's Graduate Research Fellowship program, creating a new National Graduate Research

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Fellowship. The program will not only continue to support the Nation's most promising students in any STEM field, but will also allow students to gain specialized experiences in areas of significant national need or of particular interest to mission agencies. Reorganizing graduate fellowships will position the Administration to implement a national strategy for fellowships and for graduate education more broadly.

- Continuing support for major graduate training programs, including \$487 million for the National Institutes of Health (NIH) Ruth L. Kirschstein National Research Service Award Institutional Research Training Grants, which provide funding to prepare individuals for careers in the biomedical, behavioral, and social sciences.

### **Informal STEM Education**

- Greater leadership and coordination by the Smithsonian: The Budget provides an additional \$25 million to the Smithsonian Institution to improve the reach of informal STEM education by ensuring that materials are aligned to what students are learning in the classroom. The Smithsonian will work with Federal S&T agencies such as the National Aeronautics and Space Administration (NASA), the U.S. Department of Agriculture (USDA), the National Institutes of Health (NIH), and other science partners to harness their unique expertise and resources to create relevant materials and curricula, on-line resources, and effective delivery and dissemination mechanisms to reach more teachers and students both inside and outside the classroom.
- Identifying best practices to engage youth and adults in STEM: The Administration proposes \$48 million for NSF's Advancing Informal Science Learning program (formerly Informal Science Education), focusing on the research and model-building contributions of the program to better understand effective means and innovative models for engaging today's young people and adults in science outside of school settings. NSF and ED will work together to ensure best practices identified through research are disseminated and used broadly in STEM Innovation Networks and other ED programs.

### **Supporting Innovation**

Building on the President's Strategy for American Innovation and the Administration's commitment to tackle the Grand Challenges of the 21<sup>st</sup> Century, the Budget proposes approximately \$65 million for the Advanced Research Projects Agency for Education (ARPA-ED), a "DARPA for Education." ARPA-ED will allow ED to support high-risk, high-return research on next-generation learning technologies. It will advance the field of education research, development and demonstration by: sponsoring the synthesis and vetting of public and private R&D efforts; identifying breakthrough development opportunities; shaping the next wave of R&D; investing in the development of new education technologies, learning systems, and digital learning materials; and identifying and transitioning the best and most relevant R&D from other Federal agencies.

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## **STEM Reorganization**

The Administration is proposing a comprehensive reorganization of STEM education programs. The 2014 Budget makes choices to enhance the impact of STEM Federal investments by reorganizing or eliminating 114 STEM education programs in 11 agencies, while increasing funding in support of a cohesive national STEM education strategy focused on four priority areas: K-12 instruction; undergraduate education; graduate fellowships; and informal education activities.

This will decrease the number of STEM programs from 226 to 112, a 50 percent reduction, in order to:

- Help Federal STEM efforts reach more students, more teachers, more effectively by re-orienting Federal policy to meet the needs of those who are delivering STEM education: school districts, States, and colleges and universities.
- Reduce fragmentation of the Federal STEM education investment, reorganizing efforts and redirecting resources around more clearly defined priorities;
- Enable rigorous evaluation and evidence-building strategies for Federal STEM education programs;
- Increase the impact of Federal investments in important areas such as graduate education by expanding resources for a more limited number of programs; and
- Provide additional resources to meet specific national goals, such preparing and recruiting 100,000 high-quality K-12 STEM teachers, recognizing and rewarding excellence in STEM instruction, strengthening the infrastructure for supporting STEM instruction and engagement; increasing the number of undergraduates with a STEM degree by one million, and broadening participation in STEM fields by underrepresented groups.

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Table. Federal STEM Education Program Funding

**Table. Federal STEM Education Program Funding by Agency**

(budget authority in millions)

	FY 2012	FY 2014	Change FY 12-14	
	Enacted	Budget	Amount	Percent
Agriculture	88	<b>85</b>	-3	-3.7%
Commerce	41	<b>36</b>	-5	-12.7%
Defense	178	<b>136</b>	-42	-23.6%
Education	529	<b>814</b>	285	53.9%
Energy	47	<b>33</b>	-14	-29.9%
Health and Human Services	578	<b>533</b>	-45	-7.8%
Homeland Security	9	<b>9</b>	-1	-8.5%
Interior	3	<b>3</b>	0	-9.0%
Transportation	99	<b>92</b>	-8	-7.5%
Environmental Protection Agency	26	<b>3</b>	-22	-86.8%
NASA	149	<b>100</b>	-49	-32.9%
National Science Foundation	1,154	<b>1,243</b>	89	7.7%
Nuclear Regulatory Commission	16	<b>1</b>	-15	-95.5%
Smithsonian Institution	0	<b>25</b>	25	--
<b>Total STEM Education</b>	2,918	<b>3,112</b>	195	6.7%

**OSTP - April 10, 2013**

STEM - Science, technology, engineering and mathematics

All comparisons are between 2012 and 2014 because of the late enactment of 2013 appropriations.